17.25

Theory Module

On-Board Refueling Vapor Recovery

How will this module help you?

The On-Board Refueling Vapor Recovery (ORVR) system will soon be adopted on all vehicles sold by MMSA. By completing this module, you will be better prepared to diagnose and repair possible malfunctions.

MITSUBISHI MOTORS
Technical Training

SAFETY IS YOUR RESPONSIBILITY

This technical training module is for use by professional Mitsubishi Motors dealership service technicians. The descriptions and procedures in this publication supplement existing service manuals, technical service bulletins, and other documents provided by Mitsubishi Motor Sales of America, Inc. (MMSA). As a result, the use of these sources may be required to ensure a proper repair.

Within this module you will find *Notes*, *Cautions,* and *Warnings*. These references provide guidance to help you do your job efficiently and safely. The definitions for these terms are listed below.

NOTE

The purpose of a *Note* is to help you do your job more efficiently. A *Note* may also provide additional information to help clarify a particular point or procedure.

CAUTION

A *Caution* alerts you to the possibility of damage to either tools, equipment, or to the vehicle itself. A *Caution* recommends that a procedure must be done in a certain way to avoid potential problems resulting from improper technique or method.

WARNING

A *Warning* alerts you to the highest level of risk. *Warnings* inform you that a procedure must be done in a particular way to minimize the chances of an accident that could result in personal injury or even loss of life.

When you see a *Note*, *Caution*, or *Warning*, be sure you understand the message before you attempt to perform any part of a service procedure. Also keep in mind it is impossible for MMSA to anticipate or evaluate every service situation a technician may encounter. For that reason, you have the final responsibility for personal safety–yours and those working around you. Be sure to always wear proper protective clothing and safety equipment, use the proper tools, and follow the repair procedures as outlined in various service publications provided by MMSA.

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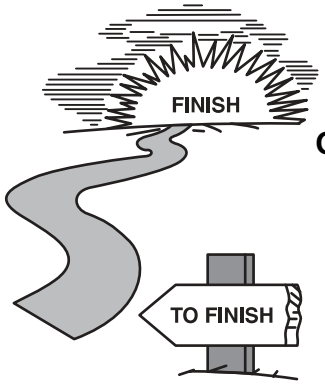


MODULE GOAL

Upon completion of this module, you will be able to identify the unique design characteristics that affect performance, diagnosis, and maintenance of the On-board Refueling Vapor Recovery (ORVR) system.

OBJECTIVES

After completing this module, you will be able to:

- Identify the benefits of an ORVR system over a conventional Strict Evaporative Emissions system.
- Describe the ORVR system operation:
  - during refueling
  - while the vehicle is parked
  - while the vehicle is being driven
- Identify the location and purpose of each of the ORVR components.

WHAT YOU WILL NEED

This module.

DIRECTIONS

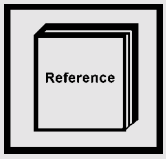
Read through this material carefully. Study each illustration as you read. Be able to answer the knowledge check questions at the end of this module.

TIME TO COMPLETE

About 30 minutes.

Module Signposts

Refer to the related video material for more information.



Refer to the related publication for more information.

Perform the related activity and answer the related questions.

Complete the Knowledge Check to verify your understanding of the material.

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OVERVIEW

During refueling, uncontrolled systems allow hydrocarbons to escape as the vehicle tank is filled.

Dual Pump Hoses

To prevent this, some states require the use of dual refueling pump hoses. Other states continue to use refueling hoses that do not control refueling vapors.

On-Board Refueling Vapor Recovery

Mitsubishi has developed an On-board Refueling Vapor Recovery System, which is part of the overall OBD-II Evaporative control system.

This ORVR system keeps fuel vapors from escaping into the environment during refueling, while the vehicle is parked, and when the vehicle is being driven.

The ORVR system offers the most effective control of refueling vapors because:

1. It operates in all 50 states because it travels with the car.

2. It controls evaporative vapors at all times.

3. It operates with any type of refueling nozzle.

APPLICATION

- 99 → Galant
- 99 → Mirage
- 98 → Eclipse (except GSX)

FUNCTION

- System controls fuel vapors at all times.
- System monitor can set DTCs and turn on MIL in case of failure.
- Diagnosis similar to previous EVAP systems.
- New scan tool tests available to verify a repair.

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From the drivers point of view, the ORVR system operates like other evaporative emissions systems.

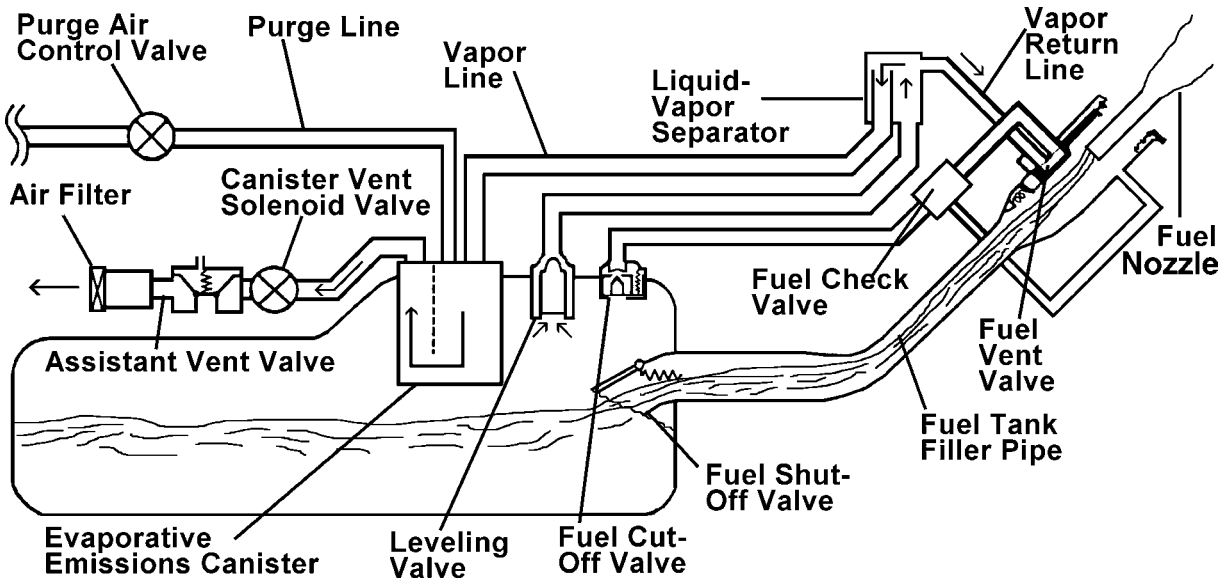
As long as the system is operating properly, the driver will be unaware.

When a system failure occurs, the OBD-II systems monitor can set DTCs and turn on the Malfunction Indicator Lamp (MIL) to inform the driver.

When a malfunction occurs, system diagnosis is similar to previous EVAP emission control systems, however there are new scan tool tests to help you quickly verify a repair.

SYSTEM OPERATION

During refueling, the Fuel filler nozzle moves the shutter valve in the fuel Vent Valve (previously called the OLFV - Over Fill Limiter Valve). This closes the passage between the Fuel Cutoff Valve and the Liquid-Vapor Separator. A small 3mm hole in the shutter valve allows some fuel vapor from the tank to recirculate into the fuel filler neck. This reduces the amount of fresh air drawn into the filler neck during refueling.



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Pressure in tank — As the tank is filled, pressure builds up inside the tank. This pressure forces vapor in the tank to pass through a “leveling valve” to a liquid-vapor separator, and then to the canister. The canister traps the hydrocarbons and releases clean air out of the vent valves, into the atmosphere.

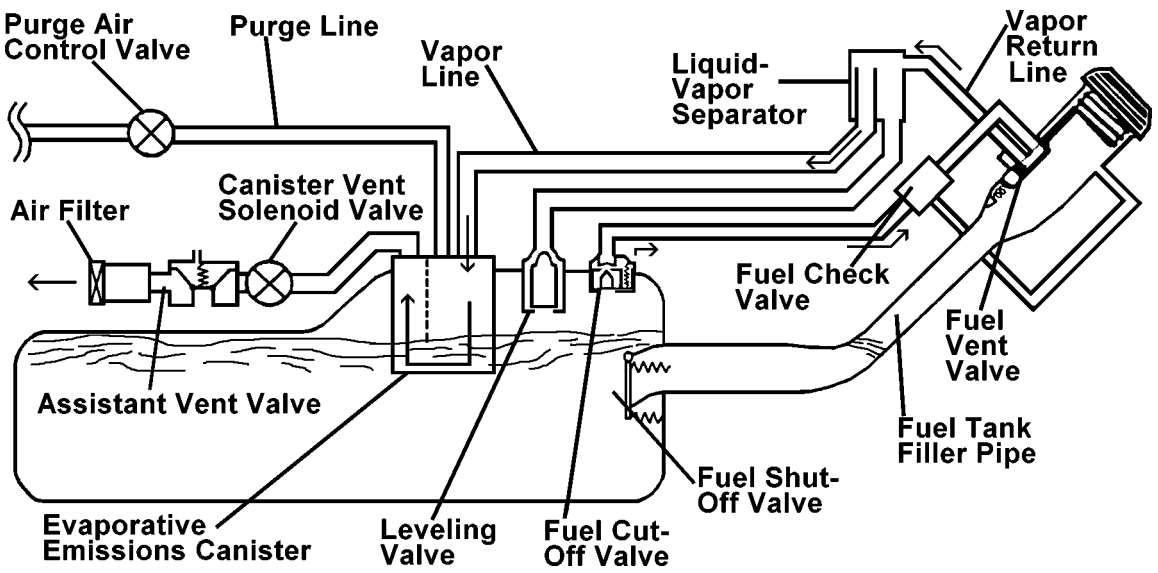
Leveling Valve — When fuel reaches a given level, the leveling valve closes to keep liquid fuel from entering the canister.

Fuel Shut-off Valve — When fuel stops flowing into the tank, the fuel shut-off valve also closes to keep fuel from flowing back up the filler pipe.

Fuel Vent Valve Shutter Valve — As the fuel tank cap is installed securely, the shutter valve in the fuel vent valve opens the passage between the fuel cut-off valve and the liquid vapor separator.

Vehicle Parked

When fuel tank is full, the leveling valve is closed by the fuel level in the tank. If fuel temperature and vapor pressure increase when parked, fuel vapor can pass through the fuel cut-off valve, fuel check valve, the fuel vent valve, the liquid-vapor separator, and into the canister. The liquid vapor separator keeps liquid fuel from entering the canister.



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Vent to atmosphere

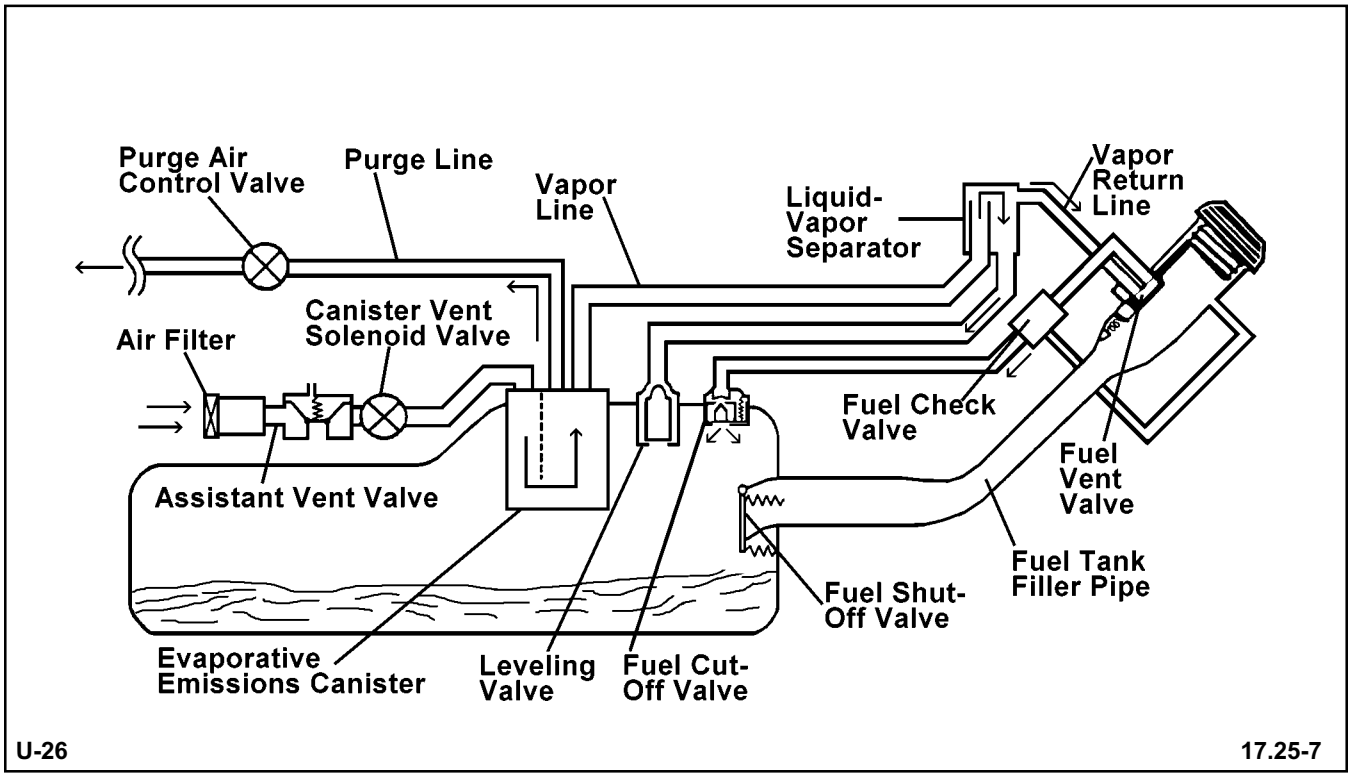
The canister traps the hydrocarbons and releases the clean air that is left, out of the vent valves into the atmosphere.

Fuel Check Valve

If pressure within the tank becomes too high, the check valve opens, allowing excessive pressure to bleed off through the fuel cap.

At all times, the fuel check valve passes vapor from the fuel cut-off valve to the fuel vent valve.

Vehicle Being Driven While driving, fresh air enters the canister for purging through the air filter.

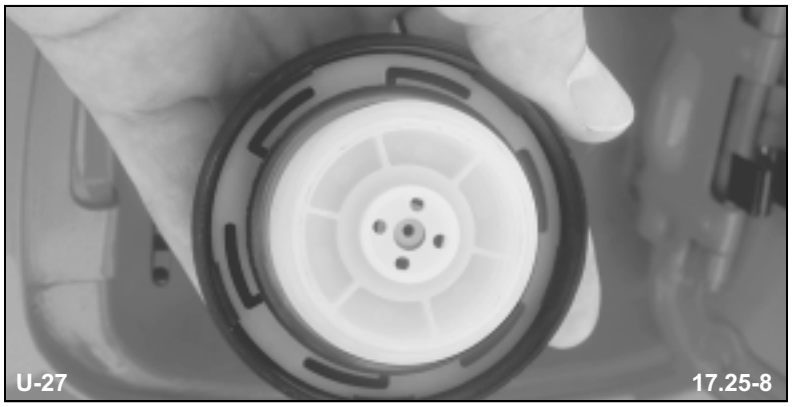


Leveling Valve As the fuel level decreases, the leveling valve opens, allowing outside air from the canister to enter the fuel tank through the liquid-vapor separator. This outside air keeps vacuum from forming in the tank.

Purging With the ORVR system, purging occurs at idle and during cruise, just like the strict evaporative emission systems found on other MMC vehicles.

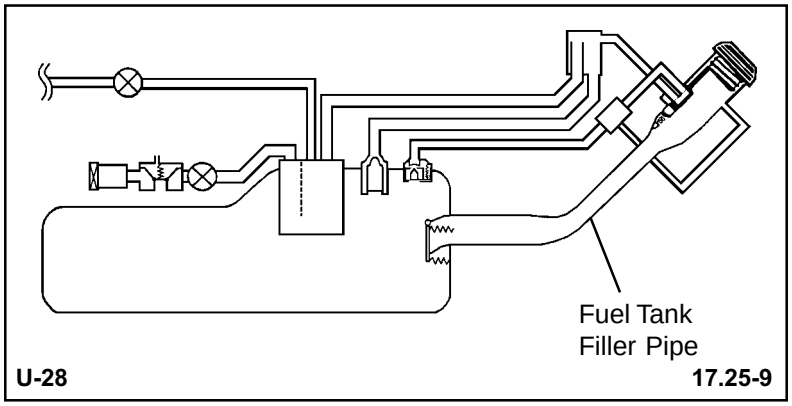
COMPONENT OPERATION

Fuel Tank Cap



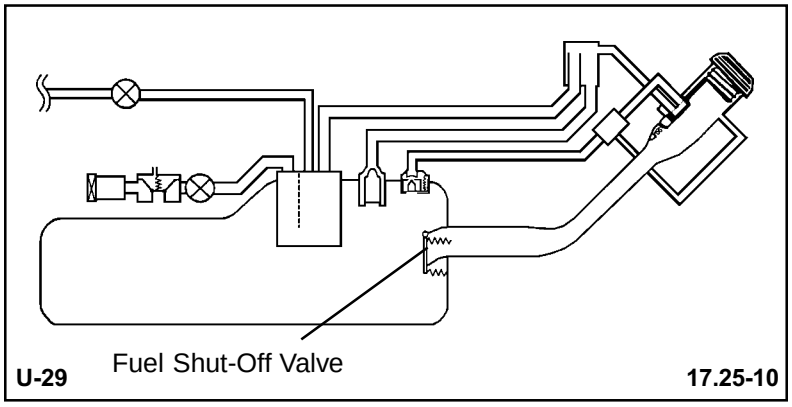
The fuel cap contains a two-way valve to vent excessive pressure released by the fuel check valve, and to prevent excessive tank vacuum build-up.

Fuel Tank Filler Pipe



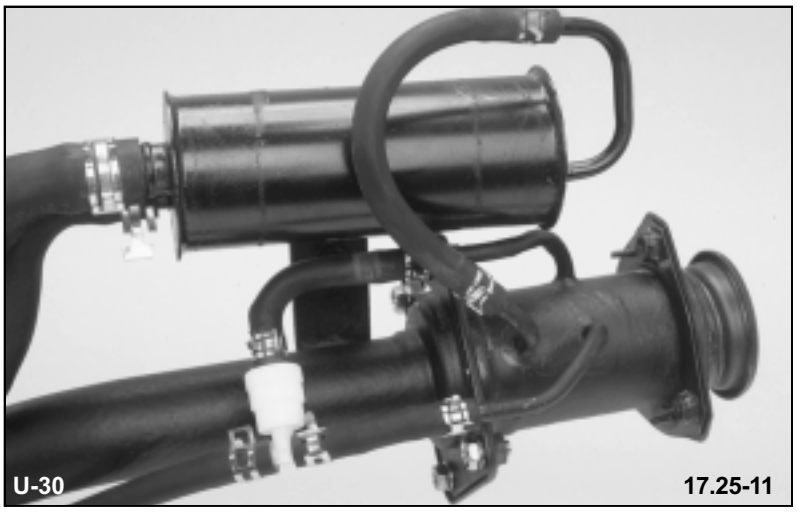
The diameter of the new fuel tank filler pipe has been reduced to 32.6mm. The smaller diameter creates a “liquid seal” during refueling. The liquid seal reduces the amount of fuel vapor escaping at the filler pipe.

Fuel Shut-off Valve



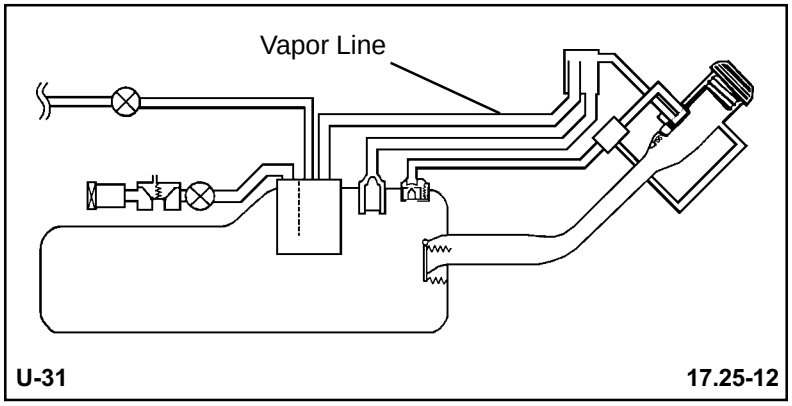
The fuel shut-off valve, located at the base of the fuel filler pipe, opens during refueling to allow fuel to enter the fuel tank. It closes after refueling to keep liquid fuel from splashing up the fuel tank filler pipe.

Vapor Return Line



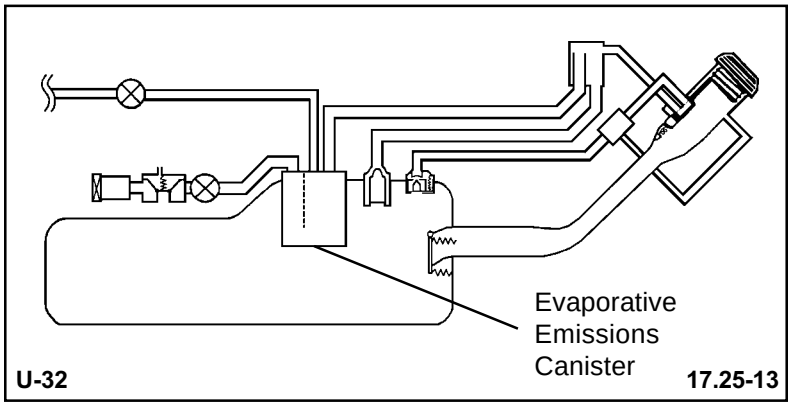
The fuel vapor return line, located between the liquid separator and the fuel filler pipe, routes fuel vapor under pressure into the fuel filler pipe. This reduces the amount of outside air drawn into the filler neck during refueling.

Vapor Line



The fuel vapor line, located between the liquid vapor separator and the canister, has a larger bore to reduce the resistance of fuel vapor flow.

Evaporative Emissions Canister



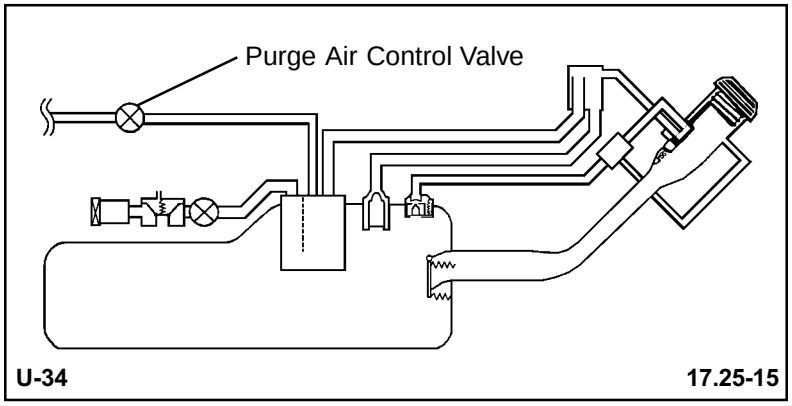
The canister is larger (2.3L capacity) and operates the same as before.

Liquid-Vapor Separator

The liquid-vapor separator is mounted outside the fuel filler pipe. Its purpose is to keep liquid fuel from entering the canister.

During an abrupt turn, it is possible for liquid fuel to exit the leveling valve and travel through the system. A standpipe inside the separator traps the liquid fuel, allowing only fuel vapor to travel to the canister.

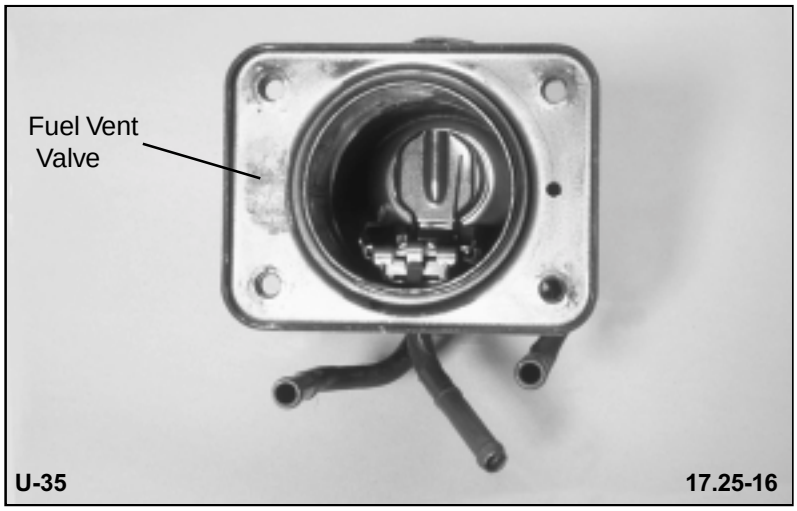
Purge Air Control Valve



The purge air control valve is connected to the canister and the engine vacuum line.

At appropriate times, the solenoid operated purge air valve opens, allowing engine vacuum to purge the canister of fuel vapor. This fuel vapor is then burned by the engine.

Fuel Vent Valve



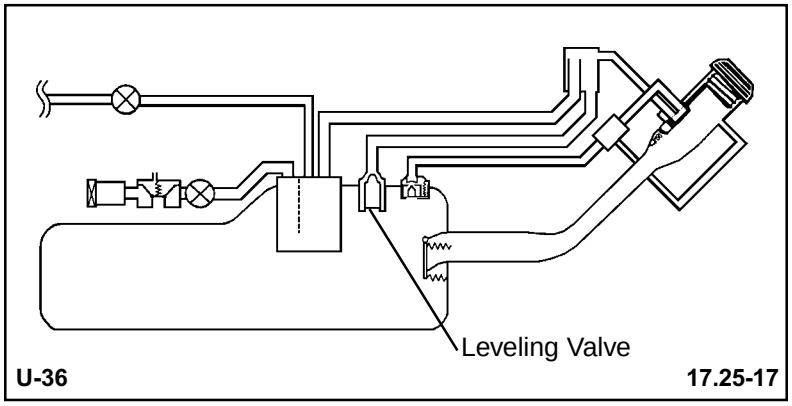
The fuel vent valve located inside the fuel filler neck was called the over fill limiter valve, or OFLV, on previous models.

When a fuel filler nozzle is inserted, the shutter valve in the fuel vent valve blocks the passage from the fuel cut-off valve. This keeps fuel vapors from flowing to the canister and escaping into the atmosphere during refueling.

A small 3-millimeter hole in the fuel vent valve also passes some vapor to the filler neck, to reduce the amount of air entering the filler neck.

As the fuel tank cap is securely tightened the shutter in the fuel vent valve opens the passage between the fuel cut-off valve and the liquid vapor separator.

Leveling Valve

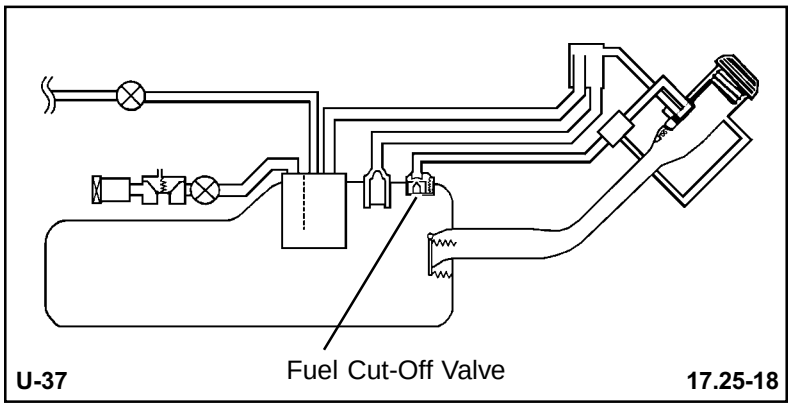


The leveling valve is mounted in the top of the fuel tank.

The valve controls the level of fuel in the tank during refueling, allows fuel vapor to leave the tank and enter the canister, and provides fuel cut-off protection.

The leveling valve vents through the liquid-vapor separator.

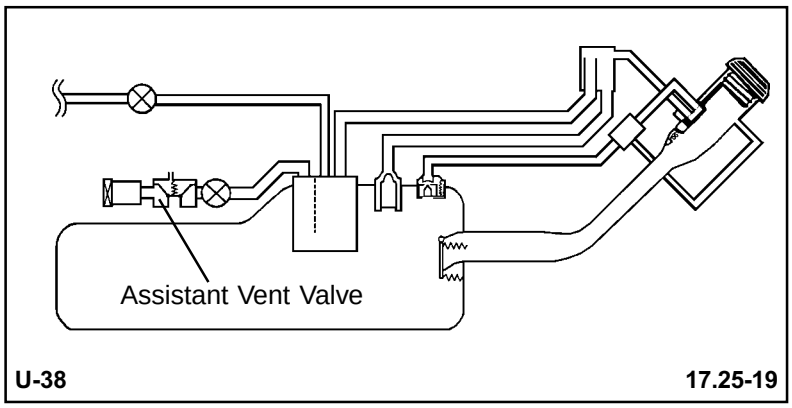
Fuel Cut-off Valve



The fuel cut-off valve, formerly called the fuel rollover valve, is mounted in the top of the fuel tank.

It allows an additional vapor path to the liquid-vapor separator and keeps the canister from being saturated with fuel during a rollover.

Assistant Vent Valve



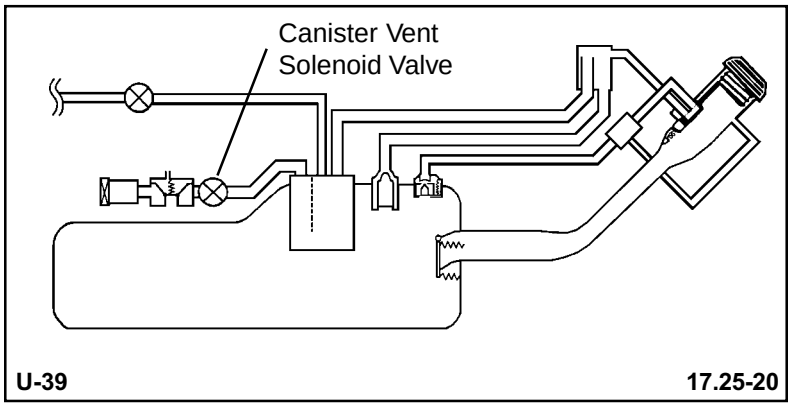
The assistant vent valve is located between the air filter and the canister vent solenoid valve.

This mechanical valve is spring loaded to the closed position.

If the air filter should become clogged, the valve moves off its seat to vent the system.

In addition, the valve provides an exit for air during refueling operations.

Canister Vent Solenoid Valve



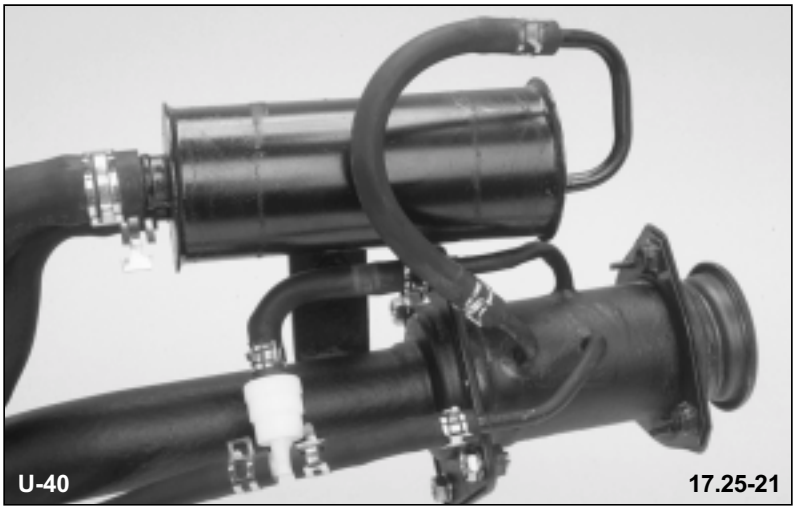
The canister vent solenoid valve is located in the line between the assistant vent valve and the vent side of the canister. It is used for the MMC and Chrysler OBD-II leak detection systems.

When performing an evaporative emissions system leak check on vehicles with the MMC ORVR system, the valve closes, allowing the engine to pull vacuum on the fuel tank.

When performing an evaporative emissions system leak check on vehicles with the Chrysler ORVR system, the valve closes to allow the leak detection pump (LDP) to pressurize the system.

The valve is open at all other times.

Fuel Check Valve

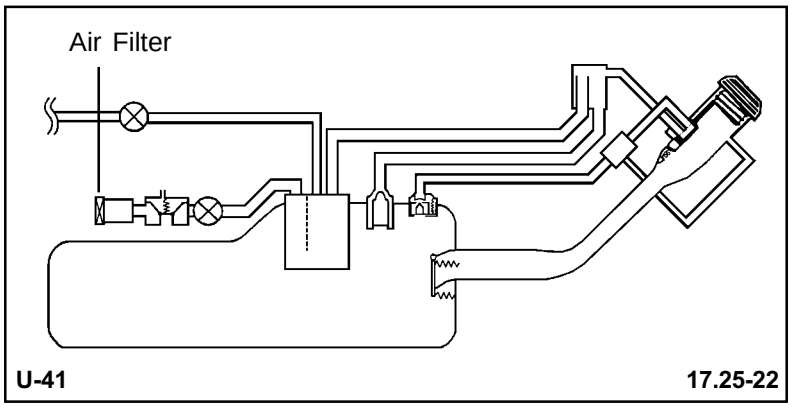


The fuel check valve has been added between the fuel vent valve and the fuel cut-off valve.

During normal operation, the fuel check valve allows vapor to travel to the fuel vent valve shutter, but **not** to the filler neck.

If pressure within the tank becomes higher than normal, the valve opens, allowing excessive pressure to bleed off through the fuel cap.

Air Filter



An air filter has been added to the vent side of the system to filter incoming air before it enters the canister.

SERVICE TIPS

- **No kinked or pinched hoses**
- **All hoses connected properly**
- **Use only factory parts**
- **Inspect vent valve for proper operation**

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When you are diagnosing or repairing a vehicle that is equipped with an on-board refueling vapor recovery (ORVR) system, be aware that:

Take care when you install hoses to ensure that are not kinked or pinched.

All vapor hoses must be connected. A disconnected vapor hose will cause the MIL to come on.

All vapor hoses and pipes should be replaced with genuine Mitsubishi parts. Using improper parts can result in the creation of a liquid sump in a vapor line. This condition can cause the MIL light to come on and refueling problems.

Check the fuel vent valve for smooth operation; refer to the Service Manual.

Inspect the fuel vent valve “flapper” to ensure that it seats properly, and is not bent, sticking, or inoperative.

SUMMARY

In this Module, you have learned how the On-Board Refueling Vapor Recovery system, or ORVR operates during refueling, while the vehicle is parked, and when the vehicle is being driven.

In addition, you have learned the names of the ORVR system components, where they are located and the role that each plays in the operation of the ORVR system.

Finally, you have been given a list of important things to remember about the operation of the ORVR system.

When using the scan tool, this knowledge will help you properly diagnose and repair any ORVR related problems; you might encounter with greater speed and accuracy.

KNOWLEDGE CHECK Choose the answer you think is the most correct.

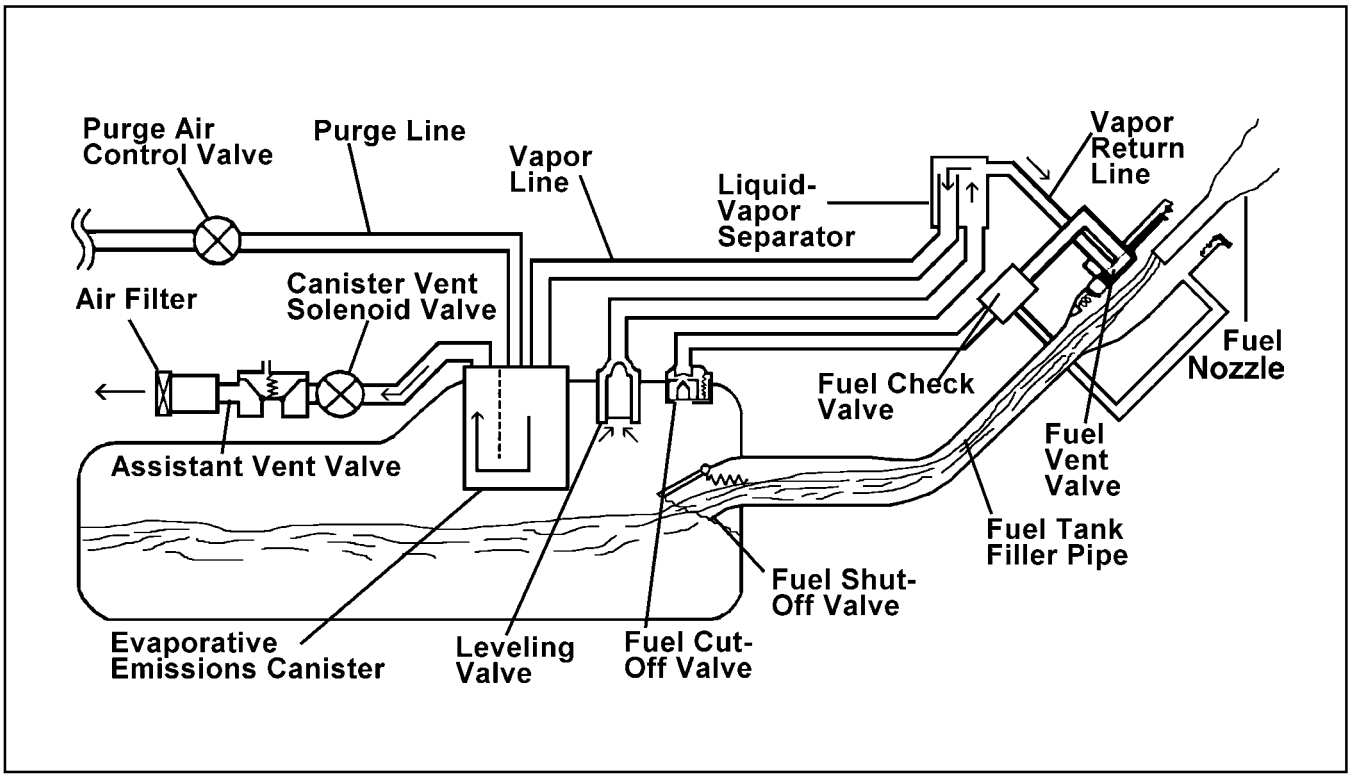
1. Why does the ORVR system offer the most effective control of refueling vapors?

   A. It operates in every state.

   B. It controls vapors at all times.

   C. It operates with any type of refueling nozzle.

   D. All of the above.



2. Refer to the illustration. During **refueling**, what is the flow path for **fuel vapor** in the tank?

   A. Fuel Cut-off Valve to Check Valve to filler neck.

   B. Leveling Valve to liquid vapor Separator to Canister.

   C. Leveling Valve to Separator to Vent Valve.

   D. Canister to Canister Vent Solenoid Valve to atmosphere.

3. Refer to the illustration. During refueling, when the tank **fuel level** reaches **a given level**, which valve closes to keep liquid from entering the canister?

   A. Leveling valve.

   B. Fuel shut-off Valve.

   C. Fuel Vent Valve shutter.

   D. Canister Vent Solenoid Valve.

4. Refer to the illustration. Two technicians are discussing the role of ORVR tank **Filler Cap tightening** after refueling.

   Technician A say “tightening the cap **opens** the shutter in the Fuel Vent Valve, and **opens** the passage between the Fuel Cut-off Valve and the liquid vapor Separator.”

   Technician B says “Tightening the cap **closes** the shutter in the Fuel Vent Valve, and **closes** the passage between the Fuel cut-off Valve and the liquid vapor Separator.”

   Who is correct?

   A. Technician A

   B. Technician B

   C. Both A and B

   D. Neither A nor B

5. Refer to the illustration. While **parked**, what is the escape path for pressurized fuel vapor if the **Canister Vent Solenoid Valve** sticks **closed**?

   A. Fuel Cut-off Valve to Check Valve to filler neck and through fuel cap.

   B. Leveling Valve to Separator to Canister.

   C. Leveling Valve to Separator to Fuel Vent Valve.

   D. Canister to Assistant Vent Valve.

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